REMARKS/ARGUMENTS

In the Office Action mailed May 14, 2009, claims 1-7 were rejected. In response, Applicants hereby request reconsideration of the application in view of the amendments and the below-provided remarks.

For reference, claim 1 is canceled, claims 2-7 are amended, and claims 8-14 are added. In particular, claim 8 is added as a new independent claim to replace canceled claim 1. The language of claim 8 is presented to clarify the relationships of the various layers and the toroidal spark gap cavity previously recited in claim 1. The language of claim 8 is supported, for example, by the subject matter recited in the original language of the claims. Claims 2-6 are each amended to depend from claim 8, rather than from canceled claim 1. Claim 7 is amended to improve the formatting of the claim and to clarify the language of the claim. Claim 7 is also amended to recite a toroidal spark gap cavity with a vertical gap between the insulating layer and the dielectric layer, and a lateral gap between the first and second electrically conductive layers. These amendments are supported, for example, by the subject matter illustrated in Figs. 1 and 6 and described in the corresponding portions of the specification.

Claims 9 is added to recite the dielectric layer extends at least partially over the window of the toroidal spark gap cavity formed by the first electrically conductive layer. Claim 10 is added to recite the dielectric layer is vertically separated from the insulating layer by the toroidal spark gap cavity. These amendments are supported, for example, by the subject matter illustrated in Figs. 1 and 6 and described in the corresponding portions of the specification. Claim 11 is added to recite means for electrically connecting the center electrode to input circuit paths to be protected from electrostatic discharge. Claim 12 is added to recite means for electrically connecting the circumferential electrode to an electrostatic discharge path comprising a connection to a circuit ground or a circuit supply voltage. These amendments are supported, for example, by the original language of claim 1. Claim 13 is added to recite the toroidal spark gap cavity is an annular cavity defined by the inner side wall of the second electrically conductive layer, the outer side wall of the first electrically conductive layer, the base layer of the insulating layer, and the cover layer of the dielectric layer. Claim 14 is added to recite at least partially

depositing the second electrically conductive layer on and in direct contact with the dielectric layer. These amendments are supported, for example, by the subject matter illustrated in Figs. 1 and 6 and described in the corresponding portions of the specification.

Claim Rejections under 35 U.S.C. 102 and 103

Claim 1 was rejected under 35 U.S.C. 102(b) as being anticipated by Kalnitsky (U.S. Pat. No. 5,786,613, hereinafter Kalnitsky). Additionally, claim 7 was rejected under 35 U.S.C. 102(b) as being anticipated by El-Kareh et al. (U.S. Pat. No. 5,933,718, hereinafter El-Kareh). Additionally, claims 2, 4, and 6 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kalnitsky in view of Momodomi et al. (U.S. Pat. No. 4,881,113, hereinafter Momodomi). Additionally, claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kalnitsky in view of Chen et al. (U.S. Pat. No. 5,656,534, hereinafter Chen). Additionally, claim 5 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kalnitsky in view of Igel et al. (U.S. Pat. No. 6,204,549, hereinafter Igel).

Given that claim 1 is canceled, Applicants submit that the rejection of claim 1 is moot. Applicants respectfully submit that the pending claims, including the newly added claims, are patentable over Kalnitsky, El-Kareh, Momodomi, Chen, and Igel for the reasons provided below.

Independent Claim 8

Applicants assert that claim 8 is patentable over the cited references because the cited references do not disclose all of the limitations of the claim. Claim 8 recites:

> An integrated circuit chip comprising:
> at least one integrated circuit; and
> an integrated electrostatic discharge protection device, the electrostatic discharge protection device comprising:
> an insulating layer disposed on a substrate layer, the insulating layer of an electrically insulating material to form a base layer of a toroidal spark gap cavity;
> a first electrically conductive layer disposed on the insulating layer, the first electrically conductive layer of a first

electrically conductive material to form a circumferential electrode with an outer side wall to define a window for the toroidal spark gap cavity;

a dielectric layer disposed on the first electrically conductive layer, the dielectric layer of a dielectric material to form a cover layer of the toroidal spark gap cavity; and

a second electrically conductive layer partially disposed directly on the dielectric layer and extending into the window for the toroidal spark gap cavity to be partially disposed directly on the insulating layer, the second electrically conductive layer of a second electrically conductive material to form a center electrode with an inner side wall that is laterally separated from the outer side wall of the first conductive layer by the toroidal spark gap cavity.

(Emphasis added.)

Neither Kalnitsky nor El-Kareh discloses all of the limitations of the claim. In particular, Kalnitsky does not disclose an electrically insulating material which forms a base layer of a toroidal spark gap cavity. Also, Kalnitsky does not disclose a dielectric material which forms a cover layer of the toroidal spark gap cavity. El-Kareh does not disclose all of the limitations of the claim because El-Kareh does not disclose a second electrically conductive layer partially disposed directly on the dielectric layer (i.e., on the dielectric material which forms the cover layer of the toroidal spark gap cavity).

1. Kalnitsky does not disclose an electrically insulating material which forms a base layer of a toroidal spark gap cavity.

Kalnitsky does not disclose an electrically insulating material which forms a base layer of a toroidal spark gap cavity. Although Kalnitsky describes an overvoltage protection device that includes two conductive elements separated by a gas filled gap (Kalnitsky, abstract), Kalnitsky does not describe an electrically insulating material which forms a base layer of the gas filled gap. As shown in Fig. 8 of Kalnitsky, the gas filled gap has a base layer that is formed by a vapour deposited layer 58. The vapour deposited layer 58 is selectively etchable and is electrically conductive in the embodiments described in Kalnitsky. Kalnitsky, col. 5 line 64, through col. 6, line 6. Therefore, the base layer of the gas filled gap is an electrically conductive layer rather than an insulting material.

For the reasons presented above, Kalnitsky does not disclose all of the limitations of the claim because Kalnitsky does not disclose an electrically insulating material which forms a base layer of a toroidal spark gap cavity. Accordingly, Applicants respectfully assert claim 1 is patentable over Kalnitsky because Kalnitsky does not disclose all of the limitations of the claim.

2. Kalnitsky does not disclose a dielectric material which forms a cover layer of the toroidal spark gap cavity.

Kalnitsky also fails to disclose a dielectric material which forms a cover layer of the toroidal spark gap cavity. Rather, Kalnitsky merely describes a second conductive layer 66 as the cover layer for the gas filled gap. Kalnitsky, col. 6, lines 45-53; Fig. 8. Although Kalnitsky describes a dielectric layer 46 between the first and second conductive layers 42 and 66, the dielectric layer does not cover the gas filled gap. The dielectric layer merely forms a portion of the sidewall of the gas filled gap. Therefore, the dielectric layer cannot be considered a cover layer for the gas filled gap because the dielectric layer does not cover the gas filled gap. Moreover, to the extent that one of the layers described in Kalnitsky might be considered a cover layer, the second conductive layer would have to be the cover layer because the second conductive layer covers the top of the gas filled gap. Therefore, Kalnitsky does not disclose a dielectric material which forms a cover layer of the gas filled gap because the second conductive layer is not a dielectric material.

For the reasons presented above, Kalnitsky does not disclose all of the limitations of the claim because Kalnitsky does not disclose a dielectric material which forms a cover layer of the toroidal spark gap cavity. Accordingly, Applicants respectfully assert claim 1 is patentable over Kalnitsky because Kalnitsky does not disclose all of the limitations of the claim because the second conductive later is not a dielectric material.

3. El-Kareh does not disclose a second electrically conductive layer partially disposed directly on the dielectric layer.

As a basis for patentability over El-Kareh, El-Kareh does not disclose a second electrically conductive layer partially disposed on the dielectric layer. For a proper

contextual understanding, it should be noted that the second electrically conductive layer also forms the center electrode of the electrostatic discharge protection device, as recited in the claim. Also, it should be noted that the dielectric layer includes the dielectric material which forms the cover layer of the toroidal spark gap cavity.

El-Kareh is generally directed to an electrostatic discharge protective device. El-Kareh, abstract. One implementation of the device is shown on the right side of Fig. 1E, in which the conductive stud 170 is able to discharge to the conductive silicide layer 154, and vice versa. El-Kareh, col. 3, lines 14-17. An oxide material 162 is etched to form a gap 164 between the conductive stud 170 and the conductive layer 154. El-Kareh, col. 3, lines 8-13. While this embodiment includes a nitride layer 156 and the conductive stud 170, the conductive material of the conductive stud 170 is not disposed on the nitride layer 156. In fact, there is no conductive material disposed on the nitride layer. Therefore, the embodiment of Fig. 1E of El-Kareh does not disclose a second conductive layer partially disposed directly on a dielectric layer. An embodiment shown in Fig. 3H of El-Kareh is structurally similar to the embodiment of Fig. 1E and, hence, also fails to disclose a second conductive layer partially disposed directly on a dielectric layer.

Another embodiment of the device is shown in Fig. 2 of El-Kareh, in which an insulator layer 180 is disposed on top of the conductive stud 170 and the nitride layer 156. However, this embodiment is similar to the embodiment of Fig. 1E in that the conductive material of the conductive stud 170 is not disposed on either the nitride layer 156 or the insulator 180. Therefore, the embodiment of Fig. 2 of El-Kareh does not disclose a second conductive layer partially disposed directly on a dielectric layer.

For the reasons presented above, El-Kareh does not disclose all of the limitations of the claim because El-Kareh does not disclose a second electrically conductive layer partially disposed directly on the dielectric layer (i.e., on the dielectric material which forms the cover layer of the toroidal spark gap cavity). Accordingly, Applicants respectfully assert claim 1 is patentable over El-Kareh because El-Kareh does not disclose all of the limitations of the claim.

Independent Claim 7

Applicants assert that claim 7 is patentable over El-Kareh because El-Kareh does not disclose all of the limitations of the claim. Claim 7 recites:

> A method of fabricating an integrated circuit chip comprising an integrated circuit and an electrostatic discharge protection device, the method comprising:
>
> providing a semiconductor substrate,
>
> depositing an insulating layer on the semiconductor substrate,
>
> depositing a first electrically conductive layer of a first electrically conductive material on said insulating layer,
>
> depositing a dielectric layer of a dielectric material directly on said first electrically conductive layer,
>
> etching the dielectric layer to form a window for a center electrode,
>
> etching the first electrically conductive layer under the dielectric layer to form a toroidal spark gap cavity with a vertical gap between the insulating layer and the dielectric layer, wherein an exposed surface of the first electrically conductive layer forms a circumferential electrode,
>
> depositing a layer of a second electrically conductive layer through the window to form the center electrode in mechanical contact with the insulating layer and to seal the toroidal spark gap cavity with a lateral gap between the first and second electrically conductive layers,
>
> connecting the center electrode to input circuit paths to be protected from electrostatic discharge, and
>
> connecting the circumferential electrode to an electrostatic discharge path comprising either a connection to a circuit ground or a circuit supply voltage.
>
> (Emphasis added.)

In contrast to the language of the claim, El-Kareh does not disclose all of the limitations of the claim. In particular, El-Kareh does not disclose etching the first electrically conductive layer under the dielectric layer to form a toroidal spark gap cavity with a vertical gap between the insulating layer and the dielectric layer. Also, El-Kareh does not disclose depositing a layer of a second electrically conductive layer through the window to seal the toroidal spark gap cavity.

1. El-Kareh does not disclose etching the first electrically conductive layer under the dielectric layer to form a toroidal spark gap cavity with a vertical gap between the insulating layer and the dielectric layer.

To the extent that the conductive silicide layer 154 of El-Kareh might be considered a first conductive layer, El-Kareh fails to disclose etching the silicide layer 154. Although El-Kareh describes a plasma etching process within the aperture 110, the etching primarily occurs at the layers of the gate oxide 151, the poly 152, and the nitride 156. El-Kareh, col. 2, lines 26-50. Thus, the etching process leaves a projection of the silicide layer 154. El-Kareh, col. 2, lines 35-36.

Moreover, even if the etching process were to etch the silicide layer 154 to some extent, the etching process nevertheless does not form a toroidal spark gap cavity with a vertical gap between the insulating layer and the dielectric layer. In particular, the etching process etches all of the layers 151, 152, and 156, and the remaining projection of the silicide layer 154 projects out from the remaining layers 151, 152, and 156. Thus, the presence of the silicide layer 154 prevents the occurrence of a vertical gap between the layers 151, 152, and 156. Therefore, El-Kareh does not disclose forming a vertical gap between an insulating layer and a dielectric layer.

For the reasons presented above, El-Kareh does not disclose all of the limitations of the claim because El-Kareh does not disclose etching the first electrically conductive layer under the dielectric layer to form a toroidal spark gap cavity with a vertical gap between the insulating layer and the dielectric layer. Accordingly, Applicants respectfully assert claim 7 is patentable over El-Kareh because El-Kareh does not disclose all of the limitations of the claim.

2. El-Kareh does not disclose depositing a layer of a second electrically conductive layer through the window to seal the toroidal spark gap cavity.

El-Kareh also fails to disclose depositing a layer of a second electrically conductive layer through the window to seal the toroidal spark gap cavity. Although the conductive stud 170 forms part of the ESD protective device, the formation of the conductive stud 170 does not seal the gap created between the conductive stud 170 and the projections of silicide 154. In fact, in the embodiments shown in Figs. 1E and 3H, the

gaps are not sealed. And in the embodiment shown in Fig. 2, the gap is not sealed by the formation of the conductive stud, but rather is sealed by the addition of the insulator 180 on top of the conductive stud and the nitride layer 156. Specifically, El-Kareh states that the top of the gap is sealed by the deposition of the next insulator layer, which does not penetrate the gap to any appreciable distance. El-Kareh, col. 3, lines 18-22. In other words, the insulator is used to seal the gap between the conductive stud 170 and the projections of silicide 154. Therefore, El-Kareh does not disclose depositing a second electrically conductive layer to seal the gap because El-Kareh specifically describes using an additional insulator layer to seal the gap.

For the reasons presented above, El-Kareh does not disclose all of the limitations of the claim because El-Kareh does not disclose depositing a layer of a second electrically conductive layer through the window to seal the toroidal spark gap cavity. Accordingly, Applicants respectfully assert claim 7 is patentable over El-Kareh because El-Kareh does not disclose all of the limitations of the claim.

Dependent Claims

Claims 2-6 and 9-14 depend from and incorporate all of the limitations of the corresponding independent claims 1 and 7. Applicants respectfully assert claims 2-6 and 9-14 are allowable based on allowable base claims. Additionally, each of claims 2-6 and 9-14 may be allowable for further reasons.

CONCLUSION

Applicants respectfully request reconsideration of the claims in view of the amendments and the remarks made herein. A notice of allowance is earnestly solicited.

Petition is hereby made under 37 CFR 1.136(a) to extend the time for response to the Office Action of 08/14/2009 to and through 09/14/2009, comprising an extension of the shortened statutory period of one month.

At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account **50-4019** pursuant to 37 C.F.R. 1.25. Additionally, please charge any fees to Deposit Account **50-4019** under 37 C.F.R. 1.16, 1.17, 1.19, 1.20 and 1.21.

Respectfully submitted,

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